

WHAT IS CLAIMED IS:

1. A high-strength forged part comprising a base phase structure and a second phase structure and containing the following components in mass % (also in the following):

C : 0.1% to 0.6%

Si+Al: 0.5% to 3%

Mn: 0.5% to 3%

P : 0.15% or less (not including 0%)

S : 0.02% or less (including 0%),

wherein the base phase structure contains 30% or more of ferrite in terms of a space factor relative to the entire structure, the second phase structure comprises retained austenite, as well as bainite and/or martensite, the content of the retained austenite is represented by the following expression (1) relative to the entire structure, an average grain diameter, d , of the second phase structure is 5 μm or less, and a space factor of a coarse portion of $(1.5 \times d)$ or more in an average grain diameter contained in the second phase structure is 15% or less:

$$50 \times [C] < [V_{\text{r}}] < 150 \times [C] \quad \dots (1)$$

where $[V_{\text{r}}]$ stands for a space factor of the retained austenite relative to the entire structure and $[C]$ stands for the content (mass %) of C in the forged part.

2. A high-strength forged part according to claim 1, further containing at least one of Cr and Mo in a total amount of 1% or less (not including 0%).

3. A high-strength forged part according to claim 1, further containing at least one of:

Ni: 0.5% or less (not including 0%) and

Cu: 0.5% or less (not including 0%).

4. A high-strength forged part according to claim 1, further containing at least one of:

Ti: 0.1% or less (not including 0%),

Nb: 0.1% or less (not including 0%), and

V : 0.1% or less (not including 0%).

5. A high-strength steel part according to claim 1, further containing at least one of:

Ca: 0.003% or less (not including 0%) and

REM: 0.003% or less (not including 0%).

6. A high-strength forged part according to claim 1, further containing:

B: 0.003% or less (not including 0%).

7. A method for producing the high-strength forged part described in claim 1, which method comprises the steps of holding steel at a temperature of (Ae1 point - 30°C) to Ae3 point for 10 seconds or more, allowing the steel to be forged at that temperature, thereafter cooling the steel to a temperature of 325° to 475°C at an average cooling rate

of 3°C/s or more, and holding the steel in that temperature range for 60 to 3600 seconds, the steel containing the following components in mass %:

C : 0.1% to 0.6%
Si+Al: 0.5% to 3%
Mn: 0.5% to 3%
P : 0.15% or less (not including 0%)
S : 0.02% or less (including 0%)

8. A high-strength forged part having a high reduction of area, the high-strength forged part comprising a base phase structure and a second phase structure and containing the following components in mass % (also in the following):

C : 0.1% to 0.5%
Si+Al: 0.5% to 3%
Mn: 0.5% to 3%
P : 0.15% or less
S : 0.02% or less,

wherein the base phase structure contains 50% or more of tempered bainite or tempered martensite in terms of a space factor relative to the entire structure, the second phase structure contains retained austenite and martensite, the content of the retained austenite being 3% to 30% in terms of a space factor relative to the entire structure, and a portion of the retained austenite and martensite, which portion is 2 or less in an aspect ratio, is 25% or less in terms of a space factor.

9. A high-strength forged part according to claim 8, further containing at least one of Cr and Mo in a total amount of 1% or less (not including 0%).

10. A high-strength forged part according to claim 8, further containing:

Ni: 0.5% or less (not including 0%) and

Cu: 0.5% or less (not including 0%).

11. A high-strength forged part according to claim 8, further containing:

Ti: 0.1% or less (not including 0%),

Nb: 0.1% or less (not including 0%), and

V : 0.1% or less (not including 0%).

12. A high-strength forged part according to claim 8, further containing:

Ca: 0.003% or less (not including 0%) and

REM: 0.003% or less (not including 0%).

13. A high-strength forged part according to claim 8, further containing:

B : 0.003% or less (not including 0%).

14. A method for producing the high-strength forged part described in claim 8, which method comprises the steps of

holding steel at a temperature of (A_{e1} point - 30°C) to (A_{e3} point - 30°C) for 10 seconds or more, allowing the steel to be forged at that temperature, thereafter cooling the steel to a temperature of 325° to 475°C at an average cooling rate of 3°C/s or more, and holding the steel in that temperature range for 60 to 3600 seconds, the steel containing the following components in mass %:

C : 0.1% to 0.5%

Si+Al: 0.5% to 3%

Mn: 0.5% to 3%

P : 0.15% or less (not including 0%)

S : 0.02% or less (including 0%),

with untempered bainite structure, quenched bainite structure, untempered martensite structure, or quenched martensite structure being introduced into the steel.